1. What are the *possible Integer* roots of the polynomial below?

$$f(x) = 7x^2 + 7x + 2$$

   A. All combinations of: $\dfrac{\pm 1, \pm 2}{\pm 1, \pm 7}$

   B. $\pm 1, \pm 7$

   C. $\pm 1, \pm 2$

   D. All combinations of: $\dfrac{\pm 1, \pm 7}{\pm 1, \pm 2}$

   E. There is no formula or theorem that tells us all possible Integer roots.

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2. Factor the polynomial below completely. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 9x^3 - 39x^2 + 52x - 20$$

   A. $z_1 \in [-5.01, -4.98]$, $z_2 \in [-2.06, -1.97]$, and $z_3 \in [-0.27, -0.21]$

   B. $z_1 \in [0.67, 0.72]$, $z_2 \in [1.62, 1.68]$, and $z_3 \in [1.96, 2.08]$

   C. $z_1 \in [0.45, 0.64]$, $z_2 \in [1.45, 1.53]$, and $z_3 \in [1.96, 2.08]$

   D. $z_1 \in [-2, -1.9]$, $z_2 \in [-1.83, -1.63]$, and $z_3 \in [-0.68, -0.64]$

   E. $z_1 \in [-2, -1.9]$, $z_2 \in [-1.6, -1.45]$, and $z_3 \in [-0.62, -0.56]$

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3. Factor the polynomial below completely, knowing that $x - 5$ is a factor. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3 \leq z_4$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 15x^4 - 41x^3 - 266x^2 + 512x - 160$$

   A. $z_1 \in [-5.3, -4.1]$, $z_2 \in [-2.37, -1.54]$, $z_3 \in [-0.37, -0.19]$, and $z_4 \in [2.7, 4.3]$

   B. $z_1 \in [-4.6, -0.9]$, $z_2 \in [0.42, 0.84]$, $z_3 \in [2.4, 2.57]$, and $z_4 \in [4.4, 5.1]$

C. $z_1 \in [-5.3, -4.1]$, $z_2 \in [-1.77, -1.09]$, $z_3 \in [-0.65, -0.35]$, and $z_4 \in [2.7, 4.3]$

D. $z_1 \in [-5.3, -4.1]$, $z_2 \in [-2.52, -2.43]$, $z_3 \in [-0.84, -0.7]$, and $z_4 \in [2.7, 4.3]$

E. $z_1 \in [-4.6, -0.9]$, $z_2 \in [0.35, 0.54]$, $z_3 \in [1.29, 1.39]$, and $z_4 \in [4.4, 5.1]$

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4. Factor the polynomial below completely, knowing that $x+5$ is a factor. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3 \leq z_4$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 10x^4 + 53x^3 - 39x^2 - 310x - 200$$

A. $z_1 \in [-2.56, -2.48]$, $z_2 \in [0.49, 1.07]$, $z_3 \in [1.47, 2.9]$, and $z_4 \in [3.3, 5.3]$

B. $z_1 \in [-5.02, -4.99]$, $z_2 \in [-2.01, -1.47]$, $z_3 \in [-1.12, -0.05]$, and $z_4 \in [0.6, 3.6]$

C. $z_1 \in [-5.02, -4.99]$, $z_2 \in [-2.01, -1.47]$, $z_3 \in [-1.29, -1.2]$, and $z_4 \in [-0.5, 1.1]$

D. $z_1 \in [-0.48, -0.31]$, $z_2 \in [1.22, 1.73]$, $z_3 \in [1.47, 2.9]$, and $z_4 \in [3.3, 5.3]$

E. $z_1 \in [-0.52, -0.47]$, $z_2 \in [1.99, 2.21]$, $z_3 \in [3.32, 5.3]$, and $z_4 \in [3.3, 5.3]$

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5. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{20x^3 + 118x^2 + 94x + 16}{x + 5}$$

A. $a \in [16, 25]$, $b \in [-5, 2]$, $c \in [100, 110]$, and $r \in [-621, -614]$.

B. $a \in [-102, -98]$, $b \in [-387, -379]$, $c \in [-1818, -1815]$, and $r \in [-9072, -9061]$.

C. $a \in [-102, -98]$, $b \in [618, 620]$, $c \in [-2998, -2994]$, and $r \in [14988, 14999]$.

D. $a \in [16, 25]$, $b \in [16, 22]$, $c \in [2, 8]$, and $r \in [-4, 0]$.

E. $a \in [16, 25]$, $b \in [216, 224]$, $c \in [1182, 1188]$, and $r \in [5935, 5938]$.

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6. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{15x^3 + 35x^2 - 15}{x + 2}$$

A. $a \in [-37, -28], b \in [-34, -21], c \in [-58, -46]$, and $r \in [-121, -110]$.

B. $a \in [13, 17], b \in [63, 67], c \in [129, 131]$, and $r \in [242, 246]$.

C. $a \in [13, 17], b \in [3, 8], c \in [-11, -9]$, and $r \in [4, 6]$.

D. $a \in [-37, -28], b \in [93, 96], c \in [-191, -184]$, and $r \in [364, 367]$.

E. $a \in [13, 17], b \in [-15, -5], c \in [27, 36]$, and $r \in [-105, -98]$.

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7. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{6x^3 - 18x - 14}{x - 2}$$

A. $a \in [6, 9], b \in [-14, -11], c \in [4, 11]$, and $r \in [-30, -19]$.

B. $a \in [6, 9], b \in [1, 10], c \in [-12, -11]$, and $r \in [-30, -19]$.

C. $a \in [11, 13], b \in [24, 26], c \in [29, 33]$, and $r \in [40, 49]$.

D. $a \in [11, 13], b \in [-24, -23], c \in [29, 33]$, and $r \in [-81, -72]$.

E. $a \in [6, 9], b \in [9, 14], c \in [4, 11]$, and $r \in [-4, -1]$.

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8. What are the *possible Rational* roots of the polynomial below?

$$f(x) = 4x^3 + 2x^2 + 7x + 7$$

A. All combinations of: $\dfrac{\pm 1, \pm 7}{\pm 1, \pm 2, \pm 4}$

B. All combinations of: $\dfrac{\pm 1, \pm 2, \pm 4}{\pm 1, \pm 7}$

C. $\pm 1, \pm 2, \pm 4$

D. $\pm 1, \pm 7$

E. There is no formula or theorem that tells us all possible Rational roots.

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9. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{20x^3 - 67x^2 - 155x - 53}{x - 5}$$

A. $a \in [20, 22], \ b \in [29, 39], \ c \in [4, 14], \text{ and } r \in [-5, -2].$

B. $a \in [20, 22], \ b \in [-170, -166], \ c \in [677, 685], \text{ and } r \in [-3457, -3448].$

C. $a \in [99, 105], \ b \in [-569, -562], \ c \in [2678, 2688], \text{ and } r \in [-13455, -13451].$

D. $a \in [20, 22], \ b \in [11, 15], \ c \in [-107, -100], \text{ and } r \in [-468, -461].$

E. $a \in [99, 105], \ b \in [428, 436], \ c \in [2005, 2011], \text{ and } r \in [9992, 9998].$

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10. Factor the polynomial below completely. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 12x^3 - 13x^2 - 59x - 30$$

A. $z_1 \in [-1.53, -1.3], \ z_2 \in [-0.81, -0.72], \text{ and } z_3 \in [2.54, 3.21]$

B. $z_1 \in [-3.01, -2.71], \ z_2 \in [0.63, 0.72], \text{ and } z_3 \in [1.21, 1.29]$

C. $z_1 \in [-3.01, -2.71], \ z_2 \in [0.24, 0.55], \text{ and } z_3 \in [1.99, 2.09]$

D. $z_1 \in [-1.34, -1.02], \ z_2 \in [-0.67, -0.6], \text{ and } z_3 \in [2.54, 3.21]$

E. $z_1 \in [-3.01, -2.71], \ z_2 \in [0.72, 0.85], \text{ and } z_3 \in [1.38, 1.64]$
